

LARGE consignments of whitefish and trout ova have arrived at the South Kensington Aquarium from America as a presentation from the Commissioners of that country. In consequence of the success attending the introduction of the first-named fish into this country last year, special attention is to be given to their culture during the present season with a view to their distribution in some of our chief lakes. The National Fish Culture Association have extended their hatchery, and, in order to secure healthy embryos, have adopted the new method, viz. the "under-flow" system, which has been found to incubate the ova at a less rate of mortality than the "overflow" system.

DR. SAMUEL TENNY, the indefatigable investigator of Roman antiquities on and around the Lake of Constance, has now at last succeeded in laying bare the forum of the old Roman city of Brigantium (Bregentz), the so-called "Rhätische Pompeii." It consists of an area on the "Oelrain" inclosed by a wall furnished with roofed halls. There are also the remains of a building with stairs and eight columns, evidently a portico of imposing proportions, besides two gates leading to streets. The remains are unfortunately in a very dilapidated condition, and their total destruction is imminent.

IN the eleven years from 1873 to 1884 the number of lions killed in Algeria was 202, for which a premium of 400*l.* has been paid by the Government. The number of panthers destroyed in the same period is 1214, and the money paid by the Government 720*l.* About 400*l.* has been paid for 1882 hyænas, and 1600*l.* for 27,000 jackals. The large felidæ are almost extirpated principally in the western provinces, and the lion of the desert is fast becoming a myth.

IN the *Transactions* of the Verein für Erdkunde at Halle a writer describes certain cave-dwellings in the province of Saxony. These are occasionally found in loess formations in the Balkan Peninsula (in the Lom Palanka region, for instance), but it is somewhat startling to find them used now in such a cultivated place as Saxony. They are in the neighbourhood of Halberstadt, quite close to the village of Langenstein. Here in a sandstone hill, about a dozen caves have been dug, which are used as dwellings. They have different rooms, light and dark, as well as chimneys, windows, and doors, and are said to be very dry and habitable. The writer of the account, a physician, says that he found the inhabitants quite comfortable, and that some of them had lived there for more than thirty years without suffering from any evil effects to their health.

WE have on our table the following new books:—"Zoological Record," vol. xxi. 1884 ("Zoological Record" Association); "The Definitions of Euclid," by R. Webb (Geo. Bell and Sons); "Organic Chemistry," by H. F. Morley (Churchill); "Elementary Algebra," by Chas. Smith (Macmillan and Co.); "Eminent Naturalists," by Thos. Greenwood (Simpkin and Co.).

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, deposited; two White-billed Parrakeets (*Tanygnathus albirostris*) from Celebes, a Bearded Lizard (*Amphibolurus barbatus*) from Australia, purchased; a Common Otter (*Lutra vulgaris*), British, received in exchange.

OUR ASTRONOMICAL COLUMN

THE DENSITY OF SATURN'S RING.—M. Poincaré supplies a short note on the stability of Saturn's ring in the November number of the *Bulletin Astronomique*. Laplace had shown that the ring could only be stable if it were divided into several concentric rings revolving at different speeds. M. Tisserand had confirmed this result, and had recognised that a single ring must, in order to exist, possess a much higher density than the

planet, and had calculated the maximum breadth of each elementary ring in terms of its density and mean radius. M. Poincaré has carried this investigation a step further, and shown that if the density of a ring be less than a certain amount, it will, under the influence of the slightest perturbation, no longer break up into a number of narrower rings, but into a great number of satellites, and that if the rings be fluid and turn each as a single piece, the density of the inner ring must be at least $1/5$, and of the outer ring $1/16$ that of the planet. For a ring of very small satellites (not for a fluid-ring, as M. Poincaré erroneously states), Maxwell has shown the condition to be that the density should not exceed $1/300$ part of that of Saturn.

We do not at present know the actual density of the ring from observation sufficiently accurately to make therefrom any certain inference as to its physical condition. Bessel's determination from the movement of the peri-saturnium of the orbit of Titan gave the reciprocal of the mass of the ring as compared with that of Saturn as 118, which, since the volume of the ring—adopting Bond's value of 40 miles for its thickness—is about $1/400$ that of the planet, would make its density about $3\frac{1}{4}$ times greater than the planet's. Bessel's value is, however, clearly too great, as he neglected the influence of the equatorial protuberance of Saturn on the movement of the apsides. Meyer's determination of the secular variation of the line of apsides of Titan, viz. $d\pi = 1726''\cdot5$, gives the reciprocal of the mass of the ring as 26700, but from all the six brighter satellites as 1960; the latter value closely agreeing with Tisserand's. It does not, however, seem to have been noticed that even the smallest value for the mass considerably exceeds the highest permissible in accordance with Maxwell's result, since that would make the mass of the rings only $1/120,000$ part of the planet's, an amount we cannot hope to detect with our present resources.

THE ORBIT OF TETHYS.—Herr Karl Böhlin has recently communicated to the Swedish Academy of Sciences an interesting discussion of the elements of the orbit of Tethys. The observations discussed are those of Sir Wm. Herschel, 1789, reduced by Lamont, Lamont, 1836, Sir J. Herschel, 1835-7, the Bonds, 1848-52, Secchi, 1856, Capt. Jacob, 1857-8, Newcomb and Holden, 1874-5, and Meyer, 1880-1. The elements are calculated for each period of observation, without taking account of perturbations. Herr Böhlin, then specially treating the mean longitude of the epoch, and adopting $190^{\circ}69812$ as the value of the mean motion, draws up tables of the differences between observation and calculation, and attempts to represent them by an empirical formula. The corrected value of the mean motion is $190^{\circ}698169$, almost identical with that found previously by M. Baillaud. Herr Böhlin finds that the annual motion of the peri-saturnium amounts to $33''$. M. Baillaud's results and M. Tisserand's investigations had given the value as $70''$. The excentricity is found as $0\cdot00803 \pm 0\cdot00077$.

THE ORBIT OF IAPETUS.—Prof. Asaph Hall has published a memoir containing a very full discussion of all the observations of Iapetus made at Washington from the mounting of the 26-inch refractor until February 29, 1884. His finally adopted elements are deduced from his own observations made between June 10, 1875, and the above-mentioned date. And in deducing them he has taken account of the perturbations produced by the sun, Iapetus being so distant from its primary that, notwithstanding the distance of Saturn from the sun, these perturbations cannot be neglected. The periodic time of the satellite was found, from a comparison of Herschel's observations in 1789 with the conjunctions observed in 1880 and 1881, to be $79\cdot3310152$ mean solar days. The adopted mean distance determined by two different methods of observing—one by differences of R.A. and declination, and the other by angles of position and distances, which give very accordant results, is $515''\cdot5195 \pm 0''\cdot02645$. The corresponding reciprocal of the mass of Saturn (including the planet, its ring, and its satellites) is $3481\cdot3 \pm 0\cdot54$, closely agreeing with that found by Meyer from his observations of the six brightest satellites, viz. $3482\cdot93 \pm 5\cdot50$.

A NEW METHOD OF DETERMINING THE AMOUNT OF ASTRONOMICAL REFRACTION.—M. Lœwy proposes to determine refraction by placing a glass prism with silvered faces, forming a double mirror, in front of the object-glass of an equatorial. By means of this arrangement the images of two stars—one at the zenith, and the other near the horizon—can be simultaneously viewed in the field and their distance measured. This distance will be affected by the maximum amount of refraction.

If after an interval of three or four hours, when the stars have equal zenith distances (and therefore are relatively but little displaced by refraction), the observation be repeated, the comparison of the two measures gives the means of determining the amount of refraction with great accuracy. For the success of the method it is, of course, essential that the measured distance should be absolutely independent of every possible displacement of the various parts of the apparatus in the interval between the observations. This result is attained, M. Lœwy considers, by placing the double mirror in such a position that the planes of reflection for the two stars coincide, as he finds that under these circumstances, whatever small displacements the prism may undergo, the distance in the field of the telescope measured in the plane of reflection or the projection of this distance on the trace of the plane of reflection in the field remains invariable.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 JANUARY 31—FEBRUARY 6

(For the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on January 31

Sun rises, 7h. 42m.; souths, 12h. 13m. 42' 5s.; sets, 16h. 46m.; decl. on meridian, 17° 19' S.; Sidereal Time at Sunset, 1h. 29m.

Moon (New on February 4) rises, 4h. 54m.; souths, 9h. 21m.; sets, 13h. 47m.; decl. on meridian, 18° 25' S.

Planet	Rises	Souths	Sets	Decl. on meridian
	h. m.	h. m.	h. m.	
Mercury ...	7 8 ...	11 8 ...	15 8 ...	22 23 S.
Venus ...	8 2 ...	13 48 ...	19 34 ...	3 30 S.
Mars ...	20 36* ...	3 7 ...	9 38 ...	5 23 N.
Jupiter ...	21 44* ...	3 43 ...	9 42 ...	0 59 S.
Saturn ...	13 15 ...	21 26 ...	5 37* ...	22 40 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Phenomena of Jupiter's Satellites

Jan.	h. m.		Feb.	h. m.	
31 ...	1 21	I. occ. reap.	5 ...	1 7	II. ecl. disap.
31 ...	22 30	I. tr. egr.	5 ...	5 32	I. ecl. disap.
Feb.			5 ...	5 47	II. occ. reap.
2 ...	22 19	III. ecl. disap.	6 ...	3 36	I. tr. ing.
3 ...	1 14	III. ecl. reap.	6 ...	5 51	I. tr. egr.
3 ...	2 19	III. occ. disap.	6 ...	21 53	II. tr. ing.
3 ...	5 1	III. occ. reap.			

The Phenomena of Jupiter's Satellites are such as are visible at Greenwich.

Feb. h. m. 6 ... 9 ... Venus at least distance from the Sun.

Variable Stars

Star	R.A.	Decl.	Feb.	h. m.
	h. m.	°		
U Cephei ...	0 52.2 ...	81 16 N.	1, 23	0 m
Algol ...	3 0.8 ...	40 31 N.	6, 22	39 m
λ Tauri ...	3 54.4 ...	12 10 N.	3, 2	6 m
ζ Geminorum ...	6 57.4 ...	20 44 N.	2, 9	30 m
U Monocerotis ...	7 25.4 ...	9 32 S.	3, 1	M
δ Libræ ...	14 54.9 ...	8 4 S.	5, 0	20 m
U Coronæ ...	15 13.6 ...	32 4 N.	6, 5	23 m
U Ophiuchi ...	17 10.8 ...	1 20 N.	1, 0	51 m
		and at intervals of 20		8
R Scuti ...	18 41.4 ...	5 50 S.	Feb. 5,	m
β Lyræ ...	18 45.9 ...	33 14 N.	1, 17	0 m
δ Cephei ...	22 24.9 ...	57 50 N.	4, 2	30 M

M signifies maximum; m minimum.

Meteors

The *Virginids*, R.A. 175°, Decl. 14° N., form the principal February shower. Fireballs may be looked for on February 2.

GEOGRAPHICAL NOTES

THE *Izvestia* (1885, v.) contain another letter from M. Potanin, describing his interesting journey to the Upper Hoang-ho. Leaving Si-nin (Tsin-ning) on May 2, the Expedition visited the Humbum Monastery—a trading-place for Russian goods brought from Urga and transported further to Thibet—and

crossed a high ridge of mountains, the pass having an altitude of no less than 12,000 feet above the sea. Following the valley of the Lan-chou (Dun-ho-tsan on Prjevalsky's map), they ascended to the plateau of Rchandza-tan, about 10,000 feet above the sea, leaving to the north the snow-clad mountains of Naryn-jamba, where Prjevalsky spent the winter of 1880. Only Tanguts inhabit this elevated table-land, and a few lamas who occupy several monasteries. Descending from the plateau into a deep valley, Naryn-jamba, which joins that of the Urung-vu River, they were soon compelled to climb another plateau of the same height, the Ganja-tan, also peopled by Tanguts. The Amni-Tunglyng Mountains raise their snow-covered summits towards the north. On May 16 the Expedition reached the Labran Monastery, situated at an altitude of 10,000 feet, and still containing several hundred well-built houses, some of them with two and three stories. The Gue-guen—a religious chief, who is also chief of the neighbouring Tanguts—resides at this rich monastery. From Labran, MM. Potanin and Skassi again climbed a high plateau, and followed it until they arrived at the Renu-kika Pass. A high snow-covered ridge extending west and east on the left bank of the Tao-ho, was seen to the north; it is inhabited by a tribe of Tangut robbers—the Tebu. The Tao-ho flows along a valley more than half a mile wide, between picturesque craggy mountains, the slopes of which are thickly wooded. The town Ming-cheu, situated in the same valley, could thus soon be reached. Leaving it on June 16, the Expedition easily reached also the Yali-san Mountain, which is the watershed between the tributaries of the Tao-ho and the Yang-tse-kiang, the ascent to the watershed offering no difficulties. The further journey to Si-gu-sian was made in an alpine country, intersected by deep and narrow valleys, which have a flora offering some notable differences from that of the Si-nin and Min-cheu region. The town Si-gu-sian is situated in the region of the monsoons. The further intentions of the Expedition were to go to Niang-pin, leaving M. Berezowski at Si-gu-sian to make collections of mammals and birds.

AN extraordinary meeting of the Geographical Society of Paris was held on the 21st inst. to receive M. de Brazza on his return from his latest expedition to that part of Western Africa which is now described as the French Congo. M. de Brazza gave an account of his journey undertaken in the summer of 1883, on a subsidy from the Government of 1,250,000 francs (50,000*l.*). In the beginning of June he and his party had reached Franceville on the Ogowai. At this place he concluded new treaties with the chiefs of the tracts adjoining the river, and opened warehouses for carrying on trade. After instructing in their duties the Europeans who were to remain at Franceville, M. de Brazza crossed the elevated tract which separates the basins of Ogowai and Alima to join Dr. Ballay, who was conducting negotiations with the Bapfourous, a tribe settled near the junction of the Alima with the Congo. Dr. Ballay had a steamer on the latter river, the first French vessel of the kind which had penetrated so far into these regions. M. de Brazza then narrated his adventures in the two years and nine months during which he was engaged in exploring the banks of the Ogowai, the Alima, and the Congo, in laying the foundation of eight stations.

THE *Calcutta Englishman* states that Mr. Needham, of the Assam Police, and Capt. Molesworth, of the Bengal Staff Corps, who left Sadiya on December 12 for Rima, in Thibet, have returned to Dibrugarh. They reached Rima, but were unable to enter the place, owing to the hostility of the Thibetans. Having followed the course of the Brahmaputra the whole way from Sadiya to Rima, they are able to state authoritatively that the river corresponding in size to the "Sanpo," as described by the explorer "A. K.," falls into it; and that the identity of the "Sanpo" with the Dijong may be deemed to be finally settled.

THE Government of the Congo State has commissioned several geographers to execute maps of the entire State. Lieut. Massari is surveying the right bank of the Congo between the Alima and Mobangi Rivers. The topographical party under Lieut. Junghers has surveyed Banana completely, and is now engaged, in two divisions, in surveying the districts between Banana and Boma, and between Boma and Vivi. The Swedish geographer Herr Hakanson has drawn a map of the district between the village of Mvinda, above Vivi, and the Issanghali Station.

ADVICES received in Berlin contradict the statement of the death of the German traveller, Dr. Büttner, who is now alleged